



Published in final edited form as:

Am J Ind Med. 2014 July ; 57(7): 819–825. doi:10.1002/ajim.22332.

Construction workers working in musculoskeletal pain and engaging in leisure-time physical activity: Findings from a mixed-methods pilot study

Alberto J. Caban-Martinez, DO, PhD, MPH¹, Kincaid Lowe, BA¹, Robert Herrick, ScD¹, Christopher Kenwood, MS², Joshua J. Gagne, MA³, Jamie F. Becker, LCSW-C⁴, Scott Schneider, MS, CIH⁴, Jack T. Dennerlein, PhD⁵, and Glorian Sorensen, PhD, MPH^{1,3}

¹Harvard School of Public Health, Boston, MA

²New England Research Institutes, Watertown, MA

³Dana-Farber Cancer Institute, Boston, MA

⁴Laborers' Health and Safety Fund of North America, Washington DC

⁵Northeastern University, MA

Abstract

Background—While exercise has been shown beneficial for some musculoskeletal pain conditions, construction workers who are regularly burdened with musculoskeletal pain may engage less in leisure-time physical activity (LTPA) due to pain. In a small pilot study, we investigate how musculoskeletal pain may influence participation in LTPA among construction workers.

Methods—A sequential explanatory mixed-methods design was employed using a jobsite-based survey (n=43) among workers at two commercial construction sites and one focus group (n=5).

Results—Over 93% of these construction workers reported engaging in LTPA and 70% reported musculoskeletal pain. Fifty-seven percent of workers who met either moderate or vigorous LTPA guidelines reported lower extremity pain (i.e. ankle, knee) compared with 21% of those who did not engage in either LTPA (p=0.04). Focus group analyses indicate that workers felt they already get significant physical activity out of their job because they are “moving all the time and not sitting behind a desk.” Workers also felt they “have no choice but to work through pain and discomfort [as the worker] needs to do anything to get the job done.”

Conclusion—Pilot study findings suggest that construction workers not only engage in either moderate or vigorous LTPA despite musculoskeletal pain but workers in pain engage in more LTPA than construction workers without pain.

Corresponding Author: Alberto J. Caban-Martinez, Department of Environmental Health, Harvard University, School of Public Health, 401 Park Drive, Landmark Center Building, 3F, East #49, Boston, Massachusetts 02215, USA, Phone: (617) 384-8768, Fax: (617) 384-8767, acaban@hsph.harvard.edu.

Conflict of Interest Statement: The Authors declare that there is no conflict of interest

Introduction

Workers employed in the construction industry frequently engage in labor-intensive and physically demanding job tasks. Heavy material handling, stooping, kneeling, crouching/crawling in awkward postures, and repetitive movements are often included in their daily job requirements and lead to the development of musculoskeletal disorders (Hunting et al., 2010). Epidemiologic studies of the construction workforce have documented high levels of self-reported musculoskeletal pain in different anatomic regions and include reports of multisite musculoskeletal pain (Guo et al., 2004; Merlino et al., 2003; Schneider, 2001; Sturmer et al., 1997). In a recent study among Hispanic construction workers, 47% of the workers reported chronic musculoskeletal pain lasting at least 30 days; of these, 87% indicated that the musculoskeletal pain interfered with their work activities and 52% had two or more anatomic sites with pain (Caban-Martinez et al., 2010). Nonetheless, it is less clear how their musculoskeletal pain affects their physical activity levels outside of work, including their engagement in leisure-time physical activity.

Physical inactivity outside of the workplace among the U.S. population is believed to be fairly widespread. National surveys have found that about one in four adults (more women than men) currently have a sedentary lifestyle with no leisure-time physical activity. An additional one third of adults have activity levels that are insufficient to achieve health benefits (National Institutes of Health [NIH] Consensus Conference, 1996; U.S. Department of Health and Human Services, 1996). Notably physical inactivity has been linked to musculoskeletal pain as well as hypertension, chronic fatigue, and physiological and mental inefficiency (Ardell, 1996), thus there may be high costs associated with an inactive lifestyle. Due to an older construction workforce, many of these workers are at much greater risk for the onset of a variety of chronic diseases, including chronic musculoskeletal pain, for which physical inactivity is a significant risk factor (Le Marchand et al., 1997; Shephard, 1997). Despite their employment in physically demanding jobs, do construction workers engage in physical activity outside of work, even when they have pain?

In order to examine this research question, we conducted a pilot study using an explanatory sequential research design to 1) investigate the socio-demographic and occupational characteristics of construction workers engaging in leisure-time physical activity; 2) examine differences in the level of LTPA engagement (i.e., vigorous and moderate) with reported musculoskeletal pain; and 3) conduct structured in-depth focus groups to explore the extent to which workers engage in leisure-time physical activity despite their pain status, including barriers and motivation to LTPA engagement. We hypothesize that construction workers with musculoskeletal pain would likely report less engagement in LTPA than workers without pain.

Methods

Study Design

As part of a larger research study to inform the development of a workplace health intervention for construction workers, we used a sequential explanatory mixed-methods (i.e., cross-sectional survey and focus group) pilot study design to examine if self-reported

musculoskeletal pain is associated with engagement in LTPA among construction workers. We first collected anonymous, self-administered questionnaire data in calendar year 2011 from 43 workers employed at two large commercial construction sites in the New England area. In addition, one semi-structured focus group was conducted a few weeks following the administration of the onsite surveys with five different construction workers at one of the two worksites. Personal identifying information was not collected during focus groups as participants provided verbal consent for participation. The study was approved as exempt by the Institutional Review Board of the Harvard School of Public Health.

Survey Instrument

The survey instrument collected individual data on socio-demographic information (e.g. age, race, ethnicity, marital status, educational training, and health insurance), and leisure time physical activity utilizing measures from the validated survey instruments. In the National Health Interview Survey (CDC, 2012; Kuorinka et al., 1987). The musculoskeletal-related questions were selected from the validated Nordic musculoskeletal questionnaire that asked respondents: (1) “During the last 3 months, have you had pain or aching in any of the areas shown on the body diagram?”, with response options: lower back, shoulder, wrist, knee, neck, and ankles; (2) “In general, how much did this pain interfere with your normal work in the last 7 days?” with response options: not at all, a little bit, moderately, quite a bit, and extremely (Kuorinka et al., 1987). Our case definition for musculoskeletal pain included any respondent who responded in the affirmative to the question about having regular pain in an anatomic body region.

The questions on physical activity included: (1) “During the past month, other than your regular job, did you participate in any physical activities?” with response options yes or no; (2) “What type of physical activity or exercise did you spend the most time doing during the past month?” with response options listing 29 physical activity options and one open ended response option; workers were asked to indicate their top two physical activity options. For each of the top two physical activities respondents were asked: (1) “How many times per week or per month did you take part in this activity?” with an open response option for time; and (2) “And when you took part in this activity, for how many minutes or hours did you usually keep at it?” with an open response option for time. Following the CDC guidelines for LTPA defined by level of intensity (DHHS, 1999), we classified moderate activity as “any activity that makes you work as hard as brisk walking and that lasts at least 10 minutes at a time, and at least 30 minutes a day” and vigorous activity as “any activity that makes you work as hard as jogging and lasts at least 10 minutes at a time, and at least 30 minutes a day.” For each physical activity described by the survey respondent, we used the CDC guidelines (DHHS, 1999) to classify the self-reported activity as either moderate or vigorous physical activity. We also asked: “How many times per week or per month did you do physical activities to strengthen your muscles?”.

Focus Group

To complement our survey data, we recruited five construction workers for a one hour focus group utilizing a discussion guide that focused on four domains: workplace characteristics, ergonomics, physical activity/exercise, and musculoskeletal pain. We used a discussion

guide developed by project staff, which included both academic researchers and construction industry members. The discussion guide content consisted of a mix of four to seven open- and closed-ended questions for each of the domains. These focus group discussion questions were developed based on the phase one qualitative data. The research team consisted of one moderator (JG) who conducted the entire session, with two additional experienced team members assisting them in collecting paperwork, taking field notes, and writing memos (AJCM and KL). The moderator opened with a description of the purpose of the focus group and then posed the open-ended questions from the discussion guide to the group.

Data Analyses

As this is a purely descriptive study, frequency and descriptive statistics were calculated for all study variables. Worker age, a continuous variables was expressed as mean \pm the standard deviation of the mean, while categorical variables were expressed as frequency and percent. Characteristics of workers who engaged in LTPA were compared to those who did not using the independent sample *t* test or Mann-Whitney U test (continuously measured characteristics) or Pearson's Chi-square test or Fisher Exact Chi-Square test for two groups (categorical measures). P value of less than 0.05 was considered statistically significant for all tests. Statistical analysis of survey data was performed with SAS 9.3 software (SAS Institute, Inc., Cary, North Carolina, USA).

The focus group discussion was tape-recorded and transcribed by our study staff (JG) and reviewed for accuracy by the research team (AJCM and KL). The transcripts were then imported into NVivo (QSR, Melbourne, Australia) for coding, organization, and analysis. Coding was completed by one researcher (JG) engaging in line-by-line coding of the transcripts - affixing codes to each text segment. Coding and analysis followed a standard comprehensive qualitative analysis method, comprised of a two stage coding process: Level 1 structural coding and Level 2 thematic coding. Structural coding follows the structure of the focus group guide, hence every question receives a structural code that is applied to the appropriate text. Thematic coding is based on themes that arise from the structural coding, and are applied in a second pass analysis. Thematic coding follows an emergent, grounded theoretical approach. These methods are enhanced by the use of a state-of-the-art ethnographic data management software program, NVivo (QSR International). The program uses an organizer indexing system for coding, categorizing, searching, retrieving, attaching analytical memos, and creating conceptual relationship networks in textual data that has been taxonomically coded. Several of these steps enhanced the rigor and transferability of the data collection and analysis obtained in the focus group session and complemented the data from our survey instrument. Workers who completed the survey received a \$5 gift card and those workers participating in the 1-hour focus group received a \$25 gift card.

Results

Survey Results

Among the 43 workers who completed surveys (63% worksite response rate), 100% were men, 61% were 40 years and older (mean \pm standard deviation = 40 \pm 10; range 21–62), 40%

did not attend college, 78% were married or living with a partner, 88% were non-Hispanic white, 85% reported some type of health insurance, 49% were journeyman, and various trades were represented in the sample [Table 1]. Approximately 70% of workers reported musculoskeletal pain in the 3 months prior to their interview, 54% experienced two or more anatomical sites with pain, and 19% reported five or more sites. In addition, 65% of workers reported that in the seven days prior to survey administration their musculoskeletal pain interfered with their work from “a little bit” to “quite a lot.”

Over 93% of workers self-reported engagement in some type of leisure-time physical activity (LTPA) in the 30 days prior to their survey administration. On average, 47% of workers reported that they spent five or more days per week engaged in LTPA that strengthened their muscles. The top five most common self-reported LTPA in our sample include walking (n=10), bicycling (n=8), hockey (n=7), weight lifting (n=7), and gardening (n=6). Workers reporting lower levels of LTPA were older, less educated, married, and had health insurance compared to workers with moderate/vigorous levels of LTPA, although not statistically significant. Fifty-seven percent of workers who met either moderate or vigorous LTPA guidelines reported lower extremity pain (i.e. ankle, knee) compared with 21% of those who did not engage in either LTPA ($p=0.04$) [Figure 1].

Focus group discussion themes

Content analysis of focus group discussions with the 5 construction workers revealed two major thematic domains across two main focus group topics: (1) musculoskeletal pain and (2) physical activity. During the musculoskeletal pain discussion, the first thematic domain that emerged was on the topic of having to work with pain. Several participants agreed that construction workers “have no choice but to work through pain and discomfort [as the worker] needs to do anything to get the job done.” They all agreed that “you have to work it [pain] out every day and that you don’t think so much about the pain because you’re here to work and make money.” The second theme that emerged in the musculoskeletal pain topic discussion dealt with mechanisms to prevent and cope with pain. Workers stated that “because of the nature of the work, you can’t prevent musculoskeletal disorders while at work.” One worker indicated that “the job beats you up and there’s not much you can do to avoid it.” The group discussants felt that a “workplace stretch program [to help with musculoskeletal pain] would be followed [by workers] if mandated by the company.”

The second topic on physical activity also revealed two major thematic domains, the first of which dealt with exercise on the job. Several participants discussed how they get physical activity on the job because they are “moving all the time and not sitting behind a desk.” One stated that “it’s not heavy cardio, but at least [I am] moving around.” Another estimated that he gets at least 30 minutes of physical activity per day on the job, and “even more if he has to go up and down stairs.” A second emerging theme in the physical activity discussion topic included barriers and motivators to engagement in LTPA. One worker said “[having] no time” was a barrier to additional physical activity. Several participants discussed the time restraints they have due to juggling work and home life. One stated that “my day starts at 3:30am, I get home at 4:30pm and then have [to spend time with] the kids.” The same group

also noted that specific incentives such as “a drop in [my] insurance premium” or “discount to attend a gym nearby” would motivate them to engage in LTPA.

Discussion

Using a mixed-methods approach (i.e. combination of focus group and survey methods), the current pilot study indicates that construction workers work in and through pain on the worksite and engage in leisure-time physical activity despite experiencing musculoskeletal pain. We also found, contrary to our study hypothesis that a majority of the workers report engaging in varying levels of either moderate or vigorous physical activity during their leisure-time despite reporting musculoskeletal pain. For example, we found the proportion of workers with ankle and knee pain to be significantly greater for those who met either moderate or vigorous LTPA guidelines than those workers who did not meet the guidelines. It may be possible that these workers are engaging in extracurricular physical activity as a method to control their musculoskeletal pain. This would be consistent with current clinical guidelines that recommend individuals with musculoskeletal pain remain physically active although with a modified activity level in order to prevent physical deconditioning (Chou et al., 2007). It is also very possible that some construction workers have discovered that engaging in LTPA despite some baseline musculoskeletal pain improves their symptoms; however additional studies on the causality of this relationship and changes of pain severity over time are needed (Farr et al., 2008; Moller et al., 2012; Nordgren et al., 2012; Semanik et al., 2012). Gram et al, found that construction workers engaging in a 12-week exercise intervention to improve aerobic capacity had no effect on self-reported musculoskeletal pain post intervention (Gram et al., 2012). Nonetheless, time-dependent studies examining this association in working populations are also lacking.

We found through focus groups research that construction workers may be financially motivated to engage in LTPA if provided discounts on their health insurance premium or access to a fitness facility. Health behavior interventionists have identified a number of factors that influence the efficacy of financial incentives for initiating physical activity (Moller et al., 2012). Given that general construction laborers are paid on an hourly basis, financial incentives for active engagement and participation in a physical activity intervention may be useful particularly if workers feel that the activity improves their musculoskeletal pain. However, while the incentives might be a motivator to participate in LTPA, we theorize that LTPA may be a pain-coping strategy for workers with musculoskeletal pain and be a different type of motivator for engagement in LTPA. This train of thought was further highlighted in focus group discussion where workers reported experiencing different levels of musculoskeletal pain based on a combination of their physical work demands and LTPA.

Our pilot study is not without limitations. This pilot has a relatively small sample of workers from two large construction sites, who were selected using a convenience sampling frame which limits the external generalizability of the study findings to the broader construction industry; nonetheless the qualitative data collected from the focus group directly support many of the themes documented in the focus group discussion. Our main outcome measure of musculoskeletal pain and LTPA was self-reported presenting possible recall bias,

although epidemiologic studies document moderate reliability (Viikari-Juntura et al., 1996; Kurtze et al., 2008). While the survey question on musculoskeletal pain assessed the respondents experience in the 3-months prior to survey administration, the question on pain interfering with work was assessed in the prior 7-days, possibly underestimating the number of workers who had pain that interfered with their work. Despite these limitations, this small pilot study has strength in the use of both quantitative and qualitative data that complimented results obtained from each component. For example, focus group narrative pointed to the worker's mentality of engaging in physical activity despite feeling musculoskeletal pain— an observation that reinforced our initial survey data showing workers meeting LTPA recommended levels regardless of body pain location as well as the group of worker in pain reporting more LTPA than construction workers without pain (Figure 1).

Traditionally, workplace wellness programs that address various worker lifestyle factors have not been integrated well with occupational health and safety programs. If combined, workplace wellness and occupational health and safety programs present significant potential in reducing hazardous occupational workplace exposures as well as improve worker health and productivity (Reavley et al., 2010). Furthermore, there is growing appreciation and evidence that workplace interventions that integrate both health protection and health promotion programs are more effective than traditional fragmented programs (Henning et al., 2009). Therefore, understanding the relationship between musculoskeletal pain and LTPA among construction workers could inform the development of an integrated workplace program. Researchers and practitioners who are planning to develop a workplace program for construction workers with musculoskeletal pain may do well to consider the effects of engagement of LTPA in this worker population.

References

- Ardell, DB. The book of wellness : a secular approach to spirit, meaning & purpose. Amherst, N.Y: Prometheus Books; 1996.
- Caban-Martinez AJ, Lee DJ, Clarke TC, et al. Self-Reported Joint and Back Pain among Construction Workers. *Musculoskel Res.* 2010; 13:49–55.
- CDC. National Health Interview Survey. 2012. Available at: http://www.cdc.gov/nchs/nhis/about_nhis.htm
- Chou R, Qaseem A, Snow V, et al. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med.* 2007; 147:478–491. [PubMed: 17909209]
- DHHS US. Promoting physical activity: a guide for community action. 1999. Available at: http://www.cdc.gov/nccdphp/dnpa/physical/pdf/PA_Intensity_table_2_1.pdf
- Farr JN, Going SB, Lohman TG, et al. Physical activity levels in patients with early knee osteoarthritis measured by accelerometry. *Arthritis Rheum.* 2008; 59:1229–1236. [PubMed: 18759320]
- Gram B, Holtermann A, Bultmann U, et al. Does an exercise intervention improving aerobic capacity among construction workers also improve musculoskeletal pain, work ability, productivity, perceived physical exertion, and sick leave?: a randomized controlled trial. *J Occup Environ Med.* 2012; 54:1520–1526. [PubMed: 23114388]
- Guo HR, Chang YC, Yeh WY, et al. Prevalence of musculoskeletal disorder among workers in Taiwan: a nationwide study. *J Occup Health.* 2004; 46:26–36. [PubMed: 14960827]

- Henning R, Warren N, Robertson M, et al. Workplace health protection and promotion through participatory ergonomics: an integrated approach. *Public Health Rep.* 2009; 124(Suppl 1):26–35. [PubMed: 19618804]
- Hunting KL, Haile E, Nessel L, et al. Validity assessment of self-reported construction tasks. *J Occup Environ Hyg.* 2010; 7:307–314. [PubMed: 20349389]
- Kuorinka I, Jonsson B, Kilbom A, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergon.* 1987; 18:233–237. [PubMed: 15676628]
- Kurtze N, Rangul V, Hustvedt BE, et al. Reliability and validity of self-reported physical activity in the Nord-Trondelag Health Study: HUNT 1. *Scand J Public Health.* 2008; 36:52–61. [PubMed: 18426785]
- Le Marchand L, Wilkens LR, Kolonel LN, et al. Associations of sedentary lifestyle, obesity, smoking, alcohol use, and diabetes with the risk of colorectal cancer. *Cancer Res.* 1997; 57:4787–4794. [PubMed: 9354440]
- Merlino LA, Rosecrance JC, Anton D, et al. Symptoms of musculoskeletal disorders among apprentice construction workers. *Appl Occup Environ Hyg.* 2003; 18:57–64. [PubMed: 12650550]
- Moller AC, McFadden HG, Hedeker D, et al. Financial motivation undermines maintenance in an intensive diet and activity intervention. *J Obes.* 2012; 2012:740519. [PubMed: 22548152]
- Nordgren B, Friden C, Demmelmaier I, et al. Long-term health-enhancing physical activity in rheumatoid arthritis - the PARA 2010 study. *BMC Public Health.* 2012; 12:397. [PubMed: 22656861]
- Reavley N, Livingston J, Buchbinder R, et al. A systematic grounded approach to the development of complex interventions: the Australian WorkHealth Program--arthritis as a case study. *Soc Sci Med.* 2010; 70:342–350. [PubMed: 19896256]
- Schneider SP. Musculoskeletal injuries in construction: a review of the literature. *Appl Occup Environ Hyg.* 2001; 16:1056–1064. [PubMed: 11757902]
- Semanik PA, Chang RW, Dunlop DD. Aerobic activity in prevention and symptom control of osteoarthritis. *PM R.* 2012; 4:S37–44. [PubMed: 22632701]
- Shephard RJ. What is the optimal type of physical activity to enhance health? *Br J Sports Med.* 1997; 31:277–284. [PubMed: 9429004]
- Sturmer T, Luessenhoop S, Neth A, et al. Construction work and low back disorder. Preliminary findings of the Hamburg Construction Worker Study. *Spine (Phila Pa 1976).* 1997; 22:2558–2563. [PubMed: 9383865]
- Viikari-Juntura E, Rauas S, Martikainen R, et al. Validity of self-reported physical work load in epidemiologic studies on musculoskeletal disorders. *Scand J Work Environ Health.* 1996; 22:251–259. [PubMed: 8881013]

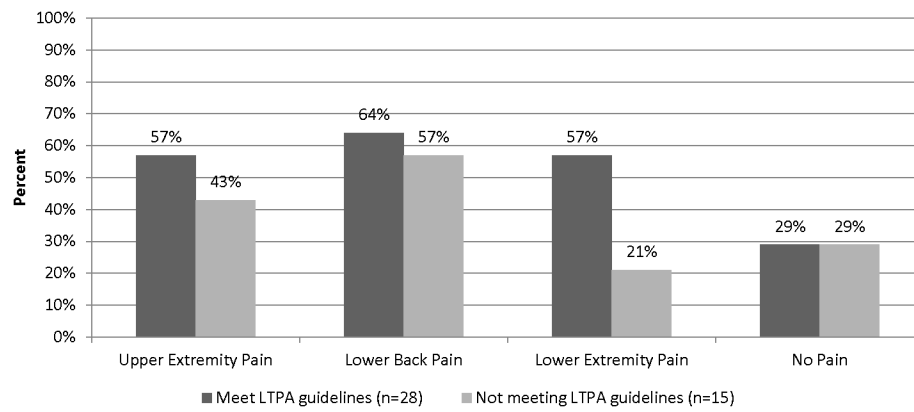


Figure 1. Percentage of construction workers meeting CDC recommended guidelines for either moderate or vigorous self-reported leisure-time physical activity (LTPA) levels by musculoskeletal pain location (n=43).

Table 1

Socio-demographic characteristics, musculoskeletal pain, and leisure-time physical activity (LTPA) among construction workers at a New England commercial construction site, 2011 (n=43, all men).

Socio-demographic Characteristics		Overall Sample (N=43) [§]	Workers Engaged in Any LTPA [†] (N=40)		% Meeting Either Moderate or Vigorous LTPA [‡] (N=28)	
		N (%)	(%)	p-value [¶]	(%)	p-value [¶]
Age						
21–39 years old		14 (39%)	100%	0.51	86%	0.08
40+ years old		22 (61%)	91%		55%	
Education						
High School Diploma/GED or Less		16 (40%)	100%	0.51	50%	0.09
Some College or College Graduate		24 (60%)	92%		79%	
Marital Status						
Married / Living with Partner		31 (78%)	94%	>0.99	65%	0.69
Unmarried / Widowed / Separated		9 (23%)	100%		78%	
Race						
White (Non-Hispanic)		35 (88%)	94%	>0.99	66%	>0.99
Non-White		5 (13%)	100%		80%	
Health Insurance						
Has Health Insurance		34 (85%)	94%	>0.99	65%	0.64
No Health Insurance		6 (15%)	100%		83%	
Job Title						
General Foreman / Foreman		12 (32%)	100%	0.68	58%	0.54
Journeyman		18 (49%)	89%		61%	
Apprentice		7 (19%)	100%		86%	
Type of Work						

Socio-demographic Characteristics		Overall Sample (N=43) [§]	Workers Engaged in Any LTPA [†] (N=40)	% Meeting Either Moderate or Vigorous LTPA [‡] (N=28)
		N (%)	(%)	p-value [‡]
Carpenter		11 (26%)	100%	64%
Demolition Worker		7 (17%)	86%	57%
Electrical Worker		6 (14%)	83%	67%
General Laborer		2 (5%)	100%	100%
Plumbers		3 (7%)	100%	33%
All Others		13 (31%)	100%	77%
Musculoskeletal Pain				
Any Pain		30 (70%)	70%	> 0.99 [*]
Upper Extremity Pain		22 (51%)	50%	0.49 [*]
Lower Back Pain		26 (60%)	60%	0.52 [*]
Lower Extremity Pain		19 (44%)	48%	0.74 [*]
				0.05 [*]
Number of Pain Sites				
None		12 (29%)	100%	67%
One Pain Site		7 (17%)	100%	43%
Two or More Pain Sites		23 (55%)	100%	74%

* p-Value (Pain vs. No Pain)

‡ p-Value (within characteristic comparison)

† Any physical activity = engagement in any physical activity outside of work in the past 30 days

‡ Moderate or Vigorous Physical Activity = defined by level of intensity CDC's guidelines on general physical activities

§ Differences in sub-total population sample due to item non-response or missing.